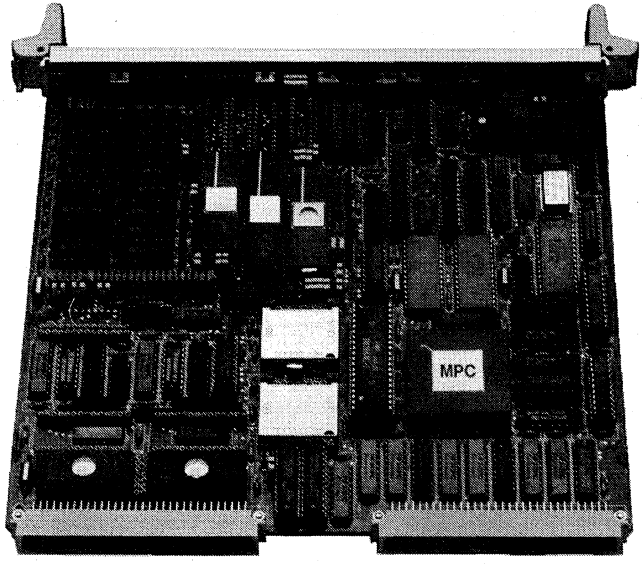
iSBC® 186/100 MULTIBUS® II SINGLE BOARD COMPUTER

- **8.0 MHz 80186 Microprocessor with Optional High Speed 8087-1 Numeric Data Coprocessor**
- **Optional 82258 Advanced DMA Controller Providing Four Additional High Peformance DMA Channels**
- **On-Board 512K Bytes DRAM Configurable as Dual Port Memory**
- **MPC (Message Passing Coprocessor) Single Chip Interface to the Parallel System Bus with Full Message Passing Capability**
- **Four (Expandable to Eight) 28-Pin JEDEC Sites for PROM, EPROM, or EEPROM**
- **24 Programmable I/O Lines Configurable as SCSI Interface, Centronics Interface, or General Purpose I/O**
- **Two Programmable Serial Interfaces, One RS 232C and the Other RS 422A with Multidrop Capabilities**
- **Resident Firmware Supporting a Reset Operating Ssytem, a Program Table, and Build-In-Self-Test (BIST) Diagnostics Including Initialization and Power-Up Tests**
- **8- or 16-bit iSBX™ IEEE P959 Interface Connector with DMA Support for I/O Expansion**

The iSBC 186/100 Single Board Computer is a member of Intel's family of microcomputer modules that utilizes the advanced features of the MULTIBUS® II system architecture. The 80186-based CPU board takes advantage of VLSI technology to provide economical, off-the-shelf, computer based solutions for OEM applications. All features of the iSBC 186/100 board, including the single chip bus interface (message passing coprocessor), reside on a 220mm x 233mm (8.7 inches x 9.2 inches) Eurocard printed circuit board and provide a complete microcomputer system. The iSBC 186/100 board takes full advantage of the MULTIBUS II bus architecture and can provide a high performance single CPU system or a powerful element for a highly integrated multi-processing application.



280263-1

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FUNCTIONAL DESCRIPTION

Overview

The iSBC 186/100 MULTIBUS II Single Board Computer utilizes the 8 MHz 80186 microprocessor to provide a range of solutions for various low cost OEM and end-user applications. Intel's commitment to offering high performance at a cost effective level are evident in the design of the iSBC 186/100 Single Board Computer. The integration of the functions of a general purpose system (CPU, memory, I/O and peripheral control) into a single board computer imply that the total system's board count, power and space requirements, and costs are reduced. Combining these cost advantages with the advanced features of the MULTIBUS II system architecture, the iSBC 1286/100 board is ideal for price sensitive MULTIBUS II multi-processing or single CPU applications. Some of the advanced featues of the MULTIBUS II architecture embodied in the iSBC 186/100 board are distributed arbitration, virtual interrupt capabilities, message passing, iPSB bus parity, and software configurability and diagnostics using interconnect address space.

Architecture

The iSBC 186/100 CPU board supports the iPSB bus features of interconnect address space, Built-In-Self-Test (BIST) diagnostics, solicited and unsolicited message passing, and memory and I/O references. In addition to supporting the iPSB bus architecture, other functions traditionally found on Intel single board computers are included in the iSBC 186/100 board. These traditional capabilities include iSBX bus expansion, high speed 8087-1 numeric coprocessor, advanced DMA control, JEDEC memory site expansion, SCSI, Centronics, or general purpose configurable parallel I/O interface, serial I/O, and programmable timers on the 808186 microprocessor. Figure 1 shows the iSBC 186/100 board block diagram.

Central Processing Unit and DMA

The 80186 is an 8.0 MHz 16-bit microprocessor combining several common system components onto a single chip (i.e., two Direct Memory Access lines, three Interval Timers, Clock Generator, and Programmable Interrupt Controller). The 80186 instruction set is a superset of the 8086 and maintains object code compatiblity while adding additional instructions.

In the basic configuration, Direct Memory Access (DMA) requests are available between the local memory and the bus interface (see Table 1). With the addition of an Advanced DMA (ADMA) 82258 controller, ADMA requests may be generated by either the iSBX interface, the SCSI interface, the bus interface controller, or the serial interface (see Table 2). The addition of the ADMA controller also allows the serial ports to be used in a full-or half-duplex multidrop application.

An additional high performance 8087-1 Numeric Data Coprocessor may be installed by the user to significantly improve the iSBC 186/100 board's numerical processing power. Depending on the application, the high speed 8087-1 will increase the performance of floating point calculations by 50 to 100 times.

Table 1. Basic DMA Configuration

80186	Local Bus
DMA Channel 0	Output DMA iPSB Bus Interface
DMA Channel 1	Input DMA iPSB Bus Interface

Memory Subsystem

The 1M byte memory space of the 80186 is divided into three main sections. The first section is the 512K bytes of installed DRAM, the second section is the window into the global 4G bytes memory space of the iPSB bus (iPSV memory window address space) which starts at 512K bytes and goes up to either 640K bytes or 768K bytes, and the third section is designated for local ROM going from the ending address of the iPSB memory window address space up to, if desired, 1M byte (see Figure 2).

The iSBC 186/100 board comes with 512K bytes of DRAM installed on the board. This memory can be used as either on-board RAM or Dual Port RAM by loading the start and end addresses into the appropriate interconnect registers. The lower boundary address to the iPSB memory window may begin at any 64K byte boundary and the upper boundary address may end at any 64K byte boundary. Refer to the iSBC 186/100 Single Board Computer User's Guide for specific information on programming address spaces into interconnect registers.

The memory subsystem supports 128K bytes or 256K bytes access to the iPSB memory address space. The iPSB memory window base address is fixed at address 512K. The position of the window in the iPSB memory address space is programmable and thus allows the CPU to access the complete 4G byte memory address space of the MULTIBUS II iPSB bus.

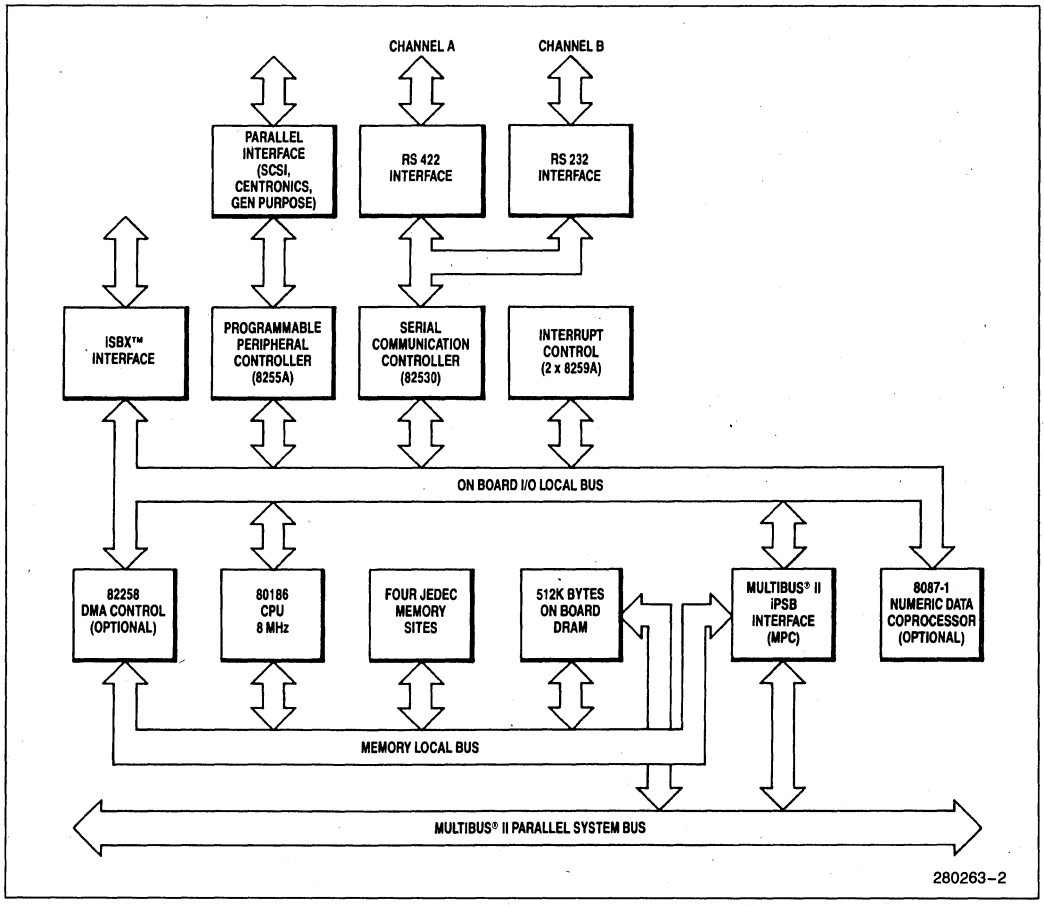

Figure 1. iSBC® 186/100 CPU Board Block Diagram

The ROM space consists of four 28-pin JEDEC sockets which take EPROMs, EEPROMs, or ROMs with 28-pin packages. An iSBC 341 28-pin MULTIMODULE™ EPROM board can be plugged into 2 of the JEDEC sockets and provide up to 512K bytes of ROM memory. Device capacities, which are jumper selectable, are supported from 8K x 8 up to 64K x 8. Once the device capacity is selected, the capacity is uniform for all sockets.

I/O access from the iSBC 186/100 CPU board across the iPSB bus is accomplished by mapping 64K bytes of local I/O access one to one to the iPSB I/O address space. However, only the upper 32K bytes are available to access the iPSB I/O address space because the lower 32K bytes on the iSBC 186/100 board are reserved for local on-board I/O.

On-Board Local Functions

PROGRAMMABLE TIMERS AND INTERRUPT CONTROL

The 80186 microprocessor on the iSBC 186/100 board provides three independent, fully programmable 16-bit interval timers/event counters. In conjunction, two 8259A Programmable Interrupt Controllers (PIC) on the iSBC 186/100 board are used in a master/slave configuration for processing on-board interrupts. At shipment, the 80186 interrupt controller and one PIC are connected as slaves to the master PIC. The first timer on the 80186 microprocessor is routed to the master Programmable Interrupt Controller and the second CPU timer is routed to the slave PIC. This architecture thus supports software

Table 2. DMA Configuration with ADMA Option

80186	Local Bus
DMA Channel 0	Serial Channel B DMA
DMA Channel 1	Serial Channel B DMA or Parallel Port
ADMA 82258	
DMA Channel 0	Input DMA Bus Interface
DMA Channel 1	Output DMA Bus Interface
DMA Channel 2	Half-duplex Fast Serial Interconnect 1 Channel A or Interrupt 1 from iSBX Bus if Used with an iSBC 341 EPROM MULTIMODULE Board
DMA Channel 3	Full-duplex Fast Serial Interconnect 1 Channel A or iSBX Bus DMA Channel if Used with an iSBC 341 EPROM MULTIMODULE board.

NOTE:
When a MULTIMODULE™ expansion board is installed and DMA support is required, then an ADMA controller must also be installed. For additional optional configurations see the *iSBC 186/100 Single Board Computer User's Guide.*

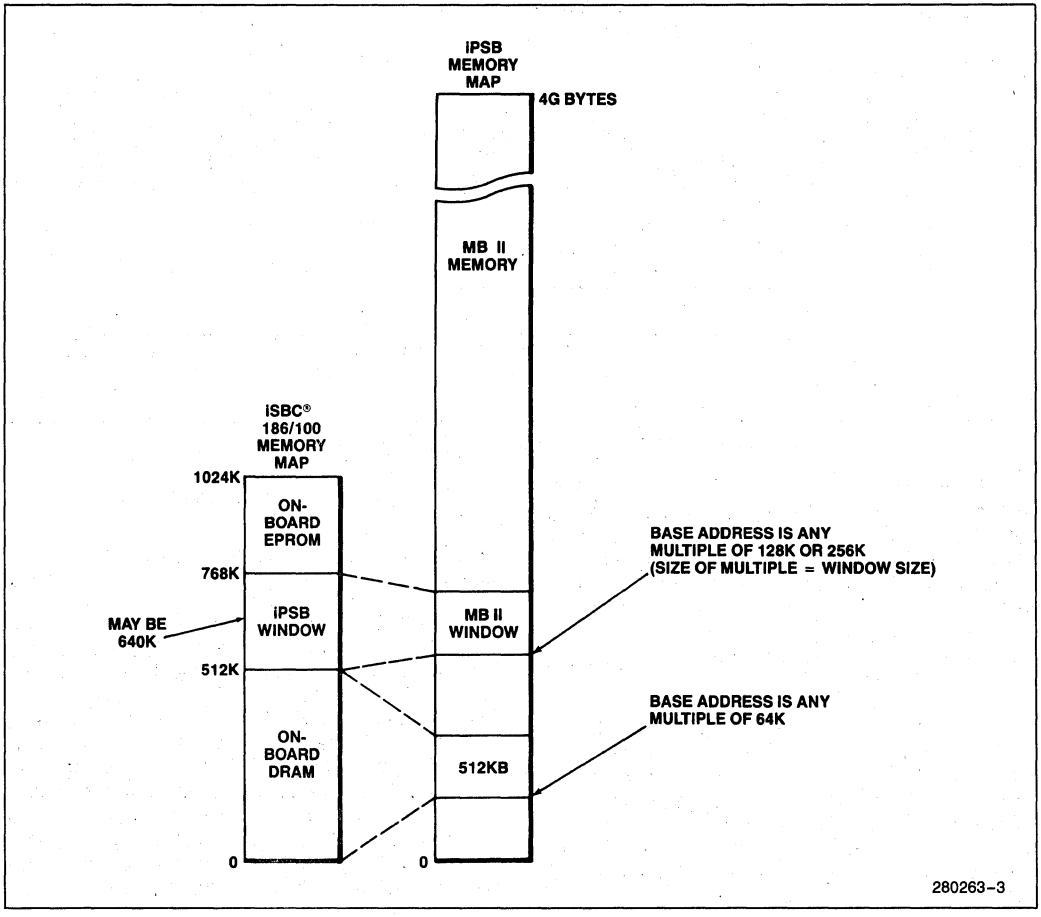

Figure 2. Memory Mapping Diagram

programmable timer interrupts. In addition, direct-vectored interrupt capability of the serial communication controller (SCC) may be used. Figure 3 depicts the interrupts in terms of their priorities.

Interrupt Services	Interrupt Priority
80186 Timer 0	Master Level 0
8087-1 Error Interrupt	1
Message Interrupt	2
iPSB Bus Error Interrupt	3
82530 SCC Interrupt	4
82258 ADMA Interrupt	5
80186 Slave PIC Interrupt	6
8259 Slave PIC Interrupt	7
PPI 0 Interrupt	Slave 0
iSBX Bus Interrupt 0	1
iSBX Bus Interrupt 1	2
Interconnect Space Interrupt	3
80186 Timer 1 Interrupt	4
PPI 1 Interrupt	5
Ground	6 & 7

Figure 3. iSBC® 186/10 Interrupt Priority Scheme

PARALLEL/SCSI PERIPHERAL INTERFACE

The iSBC 186/100 board includes an 8255A parallel peripheral interface that consists of three 8-bit parallel ports. As shipped, these ports are configured for general purpose I/O. Programmed PAL devices (Programmable Array Logic) and the bi-directional octal transceiver 74LS245 are provided to make it easy to reconfigure the parallel interface to be compatible with the SCSI (Small Computer System Interconnect) peripheral interface. Alternatively, the iSBC 186/100 board provides the jumper configuration facilities for operating the parallel interface as an interrupt driven interface for a Centronics compatible line printer by adding one PAL and reconfiguring jumpers. Both interfaces may use the 82258 DMA controller for data transfers if desired.

The SCSI interface allows multiple mass storage peripherals such as Winchester disk drives, floppy disk drives, and tape drives to be connected directly to the iSBC 186/100 board. A sample SCSI application is shown in Figure 4. The SCSI interface is compatible with SCSI controllers such as Adaptek 4500, DTC 1410, Iomega Alpha 10, Shugart 1601 and 1610, Vermont Research 8403, and Xebec 1410.

The Centronics interface requires very little software overhead since a user supplied PAL device is used to provide necessary handshake timing. Interrupts are generated for printer fault conditions and a DMA request is issued for every character.

SERIAL I/O LINES

The iSBC 186/100 board has one 82530 Serial Communciations Controller (SCC) to provide 2 channels of serial I/O. The SCC generates all baudrate clocks and provides loopback capability on both channels. Channel A is configured for RS 422A multidrop DTE application. Channel B is RS 232C only and is configured as DTE.

The multidrop configuration may either full-or half-duplex. A full-duplex multidrop configuration with a single master driving the output lines allow a slave to monitor the data line and to perform tasks in parallel with tasks performed on another slave. However, only the selected slave may transmit to the master. A half-duplex multidrop configuration is more strict in its protocol. Two data lines and a ground line are required between a master and all slaves in the system and although all units may listen to whomever is using the data line, the system software protocol must be designed to allow only one unit to transmit at any given instant.

BUILT-IN-SELF-TEST DIAGNOSTICS

On-board built-in-self-test (BIST) diagnostics are implemented using the 8751 microcontroller and the 80186 microprocessor. On-board tests include initialization tests on DRAM, EPROM, the 80186 microcontroller, and power-up tests. Additional activities performed include a Reset Operating System initialization at power-up and a program table check, a feature allowing users to add custom code in EPROM while still maintaining full use of the factory supplied BISTs.

Immediately after power-up and the 8751 microcontroller is intialized, the 80186 microprocessor begins its own initialization and on-board diagnostics. Upon successful completion of these activities, the Reset Operation System invokes the user-defined program table. A check is made of the program table and the custom programs that the user has defined for his application will then execute sequentially.

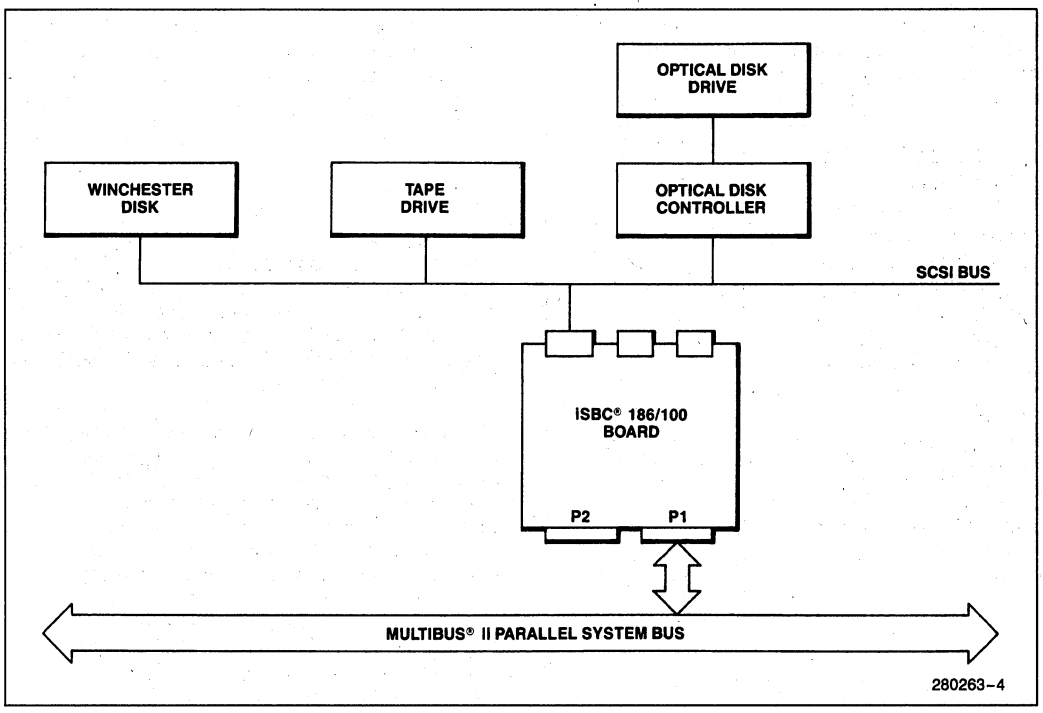

Figure 4. SCSI Application

BISTs improve the reliability, error reporting, and recovery capability of MULTIBUS II boards. In addition, these test and diagnostics reduce manufacturing and maintenance costs for the user. A yellow LED (labeled 'BIST') on the front panel indicates the status of the initialization checks and the power-up tests. It is illuminated if any of the initialization checks fail and remains off if the board successfully completes its tests. The LED also illuminates when the BIST tests start and stays on until the test complete successfully. The results of the BIST diagnostics are stored in the last 6 registers of the Header Record in Interconnect space.

iSBX™ BUS MULTIMODULE™ EXPANSION

One 8-or 16-bit iSBX bus MULTIMODULE connector is provided for I/O expansion. The iSBC 186/100 board supports both 8-bit and 16-bit iSBX modules through this connector. DMA is also supported to the iSBX connector and can be configured by programming the DMA multiplexor attached to the 82258 DMA component. The iSBX connector on the iSBC 186/100 board supports a wide variety of standard MULTIMODULE boards available from Intel and independent hardware vendors. Custom iSBX bus MULTIMODULE boards designed for MULTIBUS or proprietary bus systems are also supported as long as the IEEE P959 iSBX bus specification is followed.

iPSB BUS INTERFACE SILICON

The MPC (message passing coprocessor) provides all necessary iPSB bus interface logic on a single chip. Services provided by the MPC include memory and I/O access to the iPSB by the 80186 processor, bus arbitration, exception cycle protocols, and transfers as well as full message passing support. Dual port architecture may be implemented using the message passing coprocessor.

Interconnect Subsystem

The interconnect subsystem is one of the four MULTIBUS II address spaces, the other three being memory space, I/O space, and message space. The purpose of interconnect space is to allow software to initialize, identify, configure, and diagnose the boards in a MULTIBUS II system. All Intel MULTIBUS II boards support interconnect space.

The interconnect space is organized into a group of 8-bit registers called a template. The interconnect registers are organized into functional groups called records. Each register belongs to only one record, and there are three basic types of interconnect records: a header record, a function record, and an End of Template (EOT) record. The 80186 on the iSBC 186/100 board accesses its own template via the interconnect address space on the iPSB bus.

The header record provides board and vendor ID information, general status and control information, and diagnostic status and control information. The function record contains parameters needed to perform specific functions for the board. For example, an iPSB memory record contains registers that define the start and end address of memory for access across the iPSB bus. The number of function records in a template is determined by the manufacturer. The EOT record simply indicates the end of the interconnect template.

There are two types of registers in the MULTIBUS II interconnect space, read-only and software configurable registers. Read-only registers are used to hold information such as board type, vendor, firmware level, etc. Software configurable registers allow read and write operations under software control and are used for auto-software configurability and remote/local diagnostics and testing. A software monitor can be used to dynamically change bus memory sizes, disable or enable on-board resources such as PROM or JEDEC sites, read if the iSBX bus or PROM are installed as well as access the results of Built-In-Self-Tests or user installed diagnostics. Many of the interconnect registers on the iSBC 186/100 board perform functions traditionally done by jumper stakes. Interconnect space support is implemented with the 8751 microcontroller and iPSB bus interface logic.

SPECIFICATIONS

Word Size

INSTRUCTION: 8-, 16-, 24-, 32-, or 40-bits

DATA: 8-or 16-bits

System Clock

CPU: 8.0 MHz

NUMERIC COPROCESSOR: 8.0 MHz (part number 8087-1)

Cycle Time

BASIC INSTRUCTION: 8.0 MHz - 500 ns for minimum code read

Memory Capacity

LOCAL MEMORY

NUMBER OF SOCKETS: four 28-pin JEDEC sites

	Memory Capacity	Chip Example
EPROM	8K × 8	2764
EPROM	16K × 8	27128
EPROM	32K × 8	27256
EPROM	64K × 8	27512

ON-BOARD RAM

512K bytes 64K × 4 bit Dynamic RAM

I/O Capability

Serial:

— Two programmable channels using one 82530 Serial Communications Controller

— 19.2K baud rate maximum in full duplex in asynchronous mode or 1 megabit per second in full duplex in synchronous mode

— Channel A: RS 422A with DTE multidrop capability

— Channel B: RS 232C compatible, configured as DTE

— Parallel: SCSI, Centronics, or general purpose I/O

— Expansion: One 8-or 16-bit IEEE P959 iSBX MULTIMODULE board connector supporting DMA

Serial Communications Characteristics

ASYNCHRONOUS MODES:

- 19.2K baud rate maximum in full duplex
- 5-8-bit character; odd, even, or parity; 1, 1.5, or 2 stops bits
- Independent transmit and receive clocks, 1X, 16X, 32X, or 64X programmable sampling rate
- Error detection: Framing, Overrun, and Parity
- Break detection and generation

BIT SYNCHRONOUS MODES:

- 1 megabit per second maximum in full duplex
- SDLC/HDLC flag generation and recognition
- Automatic zero bit insertion and detection
- Automatic CRC generation and detection (CRC 16 or CCITT)
- Abort generation and detection
- I-field residue handling
- SDLC loop mode operation
- CCITT X.25 compatible

BYTE SYNCHRONOUS MODES:

- Internal or external character synchronization (1 or 2 characters)
- Automatic CRC generation and checking (CRC 16 or CCITT)
- IBM Bisync compatible

Timers

Three programmable timers on the 80186 microprocessor

INPUT FREQUENCIES:

Frequencies supplied by the internal 80186 16 MHz crystal

Serial chips: crystal driver at 9.8304 MHz divide by two

iSBX connector: 9.8304 crystal driven an 9.8304 MHz

Interrupt Capacity

POTENTIAL INTERRUPT SOURCES:

255 individual and 1 broadcast

INTERRUPT LEVELS:

12 vectored requests using two 8259As, 3 grounded inputs, and 1 input to the master PIC from the slave PIC

INTERRUPT REQUESTS:

All signals TTL compatible **INTERFACES**

IPSB BUS:

As per MULTIBUS II bus architecture specification

iSBX BUS:

As per IEEE P959 specification

CONNECTORS

Location	Function	Part #
P1	iPSB Bus	603-2-IEC-C096-F

Physical Dimensions

The iSBC 186/100 board meets all MULTIBUS II mechanical specifications as presented in the MULTIBUS II specification (#146077)

DOUBLE-HIGH EUROCARD FORM FACTOR:

Depth: 220 mm (8.7 in.)
Height: 233 mm (9.2 in.)
Front Panel Width: 20 mm (0.784 in.)
Weight: 743 g (26 oz.)

Environmental Requirements

Temperature: Inlet air at 200 LFM airflow over all boards
Non-operating: −40° to +70°C
Operating: 0° to +55°C

Humidity: Non-operating: 95% RH @55°C, non-condensing
Operating: 90% RH @ 55°C, non-condensing

Electrical Characteristics

The maximum power required per voltage is shown below. These numbers do not include the power required by the optional memory devices, SCSI PALs, or expansion modules.

Voltage (Volts)	Max Current (Amps)	Max Power (Watts)
+5	6.5 mA	34.13W
+12	50 mA	0.06W
−12	50 mA	0.06W

Reference Manuals

iSBC 186/100 Single Board Computer User's Guide (#148732-001)

Intel MULTIBUS II Bus Architecture Specification (#146077)

Manuals may be ordered from any Sales Representative, Distribution Office, or from the Intel Literature Department, 3065 Bowers Avenue, Santa Clara, CA, 95051.

ORDERING INFORMATION

Part Number	Description
SBC186100	MULTIBUS II 80186-based Single Board Computer